




المادة: Social Network Analysis
المدة: ساعة ونصف
الاستاذ: د. حسين هزيمة

المرحلة: الإجازة
السنة المنهجية: الثالثة
الاختصاص: علم البيانات - Data Science

Documents are NOT authorized

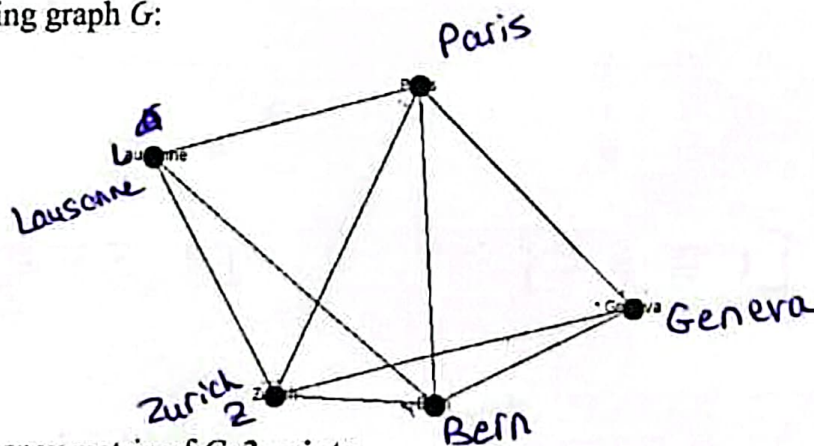
Question 1: (32 pts) multiple-choice and T/F questions:

1. A path from v_0 to v_0 in a graph G , can repeat a vertex or edge, is called	<input type="radio"/> a. Walk <input type="radio"/> b. Circuit <input checked="" type="radio"/> c. Cycle <input type="radio"/> d. Path
2. A path from v_0 to v_0 in a graph G , cannot repeat a vertex or edge, is called	<input type="radio"/> a. Walk <input checked="" type="radio"/> b. Circuit <input type="radio"/> c. Cycle <input type="radio"/> d. Path
3. Graph C_1 is called 	<input type="radio"/> a. Complete graph <input type="radio"/> b. Connected graph <input type="radio"/> c. Simple graph <input checked="" type="radio"/> d. Cycle graph

1. In directed graphs a node's edge is bidirectional.	T	F	F, it is not always bidirectional
2. A graph that has loops is called a simple graph	T	F	F, contain
3. A bipartite graph exists has no two vertices within the same set are connected.	T	F	F, has
4. A path is the same as shortest path	T	F	F
5. Local neighbourhood overlap is a node level feature	T	F	F, link level

Question 2: (30 pts) centrality measures:

1. Given the following graph G :



1. Write the adjacency matrix of G . 3 points.

2. Find the degree centrality (d_c) of each node in the network, and determine the node with the highest d_c . 10 points.

α. Calculate the closeness centrality (cc) of each node, and determine the node that has the highest cc. 10 points.

β. Assume that we added the following node(s) edge(s) to the network, to become G' , how many components does G' have?

Node	Edge(s)
Berlin	Amsterdam

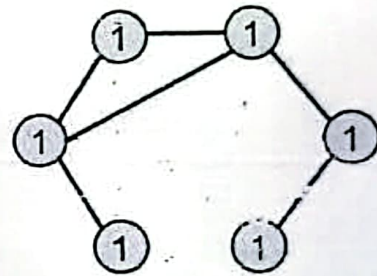
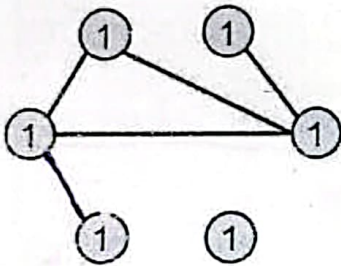
γ. Can we calculate the betweenness centrality of graph G' ? Why? 7 points

Question 3: (38 pts) graph features:

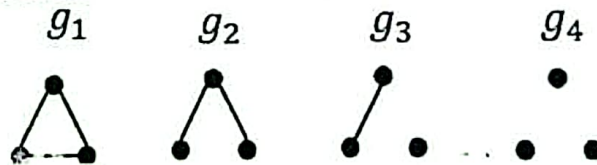
α. Find the clustering coefficient of graph G in part 3). 10 pts.

β. What is the possible number of graphlets of G ? 5 pts.

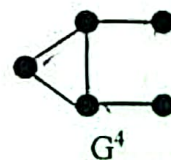
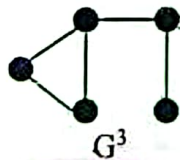
γ. Given the following two graphs G^1 and G^2 , find the similarity between these two graphs using Weisfeiler-Lehman Kernel color refinement algorithm. 15 pts



α. Given the following graphlets for $k=3$



And the following two graphs G^3 and G^4 , calculate and find the graphlet kernel $K(G^3, G^4)$ of the two graphs. 8 points.



Good Work